Space Weather Technical Forecast

Issued on Saturday, 13 July 2024 at 13:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Minor radio blackouts (R1) are Likely throughout. G1/Minor geomagnetic storm intervals are likely this weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity was Moderate in the past 24 hours, with a peak long duration flare of M1.4 observed at 13/0318UTC originating from AR3738, which is located in the southwest quadrant. There are currently eight numbered sunspot regions on the visible disc, with two new and unnumbered sunspot regions emerging on the southeast limb. AR3738 is the largest and most magnetically complex region on the disc, which consists of at least 3 delta spots within its configuration. The only other region of note is AR3743 in the southeast, which has continued to gradually develop, with the emergence of more intermediate spots. The remaining regions are all smaller, magnetically simpler, and either stable or displaying small insignificant changes.

The main events in coronagraph imagery being CMEs from narrowly behind the western limb around the turn of the UTC day 11 into 12 July, and also a prominence eruption from the southeast around 12/0500UTC. Neither is expected to be Earth directed. The aforementioned long duration M1.4 flare showed an eruption of plasma in the SDO/AIA 304 imagery, with a filament lift-off to the south of its location, although no CME has been observed in coronagraph imagery so far.

No Earth-directed Coronal Mass Ejections (CMEs) have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind conditions observed at L1 by ACE were at background levels, with solar wind speeds ranging between 320-390 km/s. Density was below average, with typical single figure ppcc. The IMF remained weak, with a peak of 6nT and a north-south (Bz) range of +5/-4nT. The phi angle was predominantly negative (towards the Sun). The result of the solar wind measures was Quiet (Kp 0-1) geomagnetic conditions.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was predominantly at Normal Background levels. The 24-hour fluence was below Active, with a gradually declining trend and 1.78e6 integrated pfu observed at 13/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: M-class flares remain Likely, with AR3738 the most probable source. No significant regions are due to depart or arrive through the period.

Solar Wind /Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Initial slow wind conditions are expected to be followed by a slight enhancement due to the onset of the fast winds from CH52, these expected to arrive later today (13th) and then persist

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for up to two days. The solar winds are expected to reach slightly elevated to temporarily elevated levels, around 450-500 km/s. Later in the period the solar wind is expected to decline to Background levels.

Initially Quiet geomagnetic conditions are expected to increase to Active to G1/Minor geomagnetic storm levels (Kp 4-5) at times from later today into tomorrow, before reverting to Quiet to Unsettled (Kp 1-3) conditions into the new UTC working week.

Energetic Particles / Solar Radiation: High energy proton flux carries a daily Slight Chance of rising to exceed S1 in response to any notable flares from AR3738. This risk increases very slightly as this region progresses westwards in the period, with other regions contributing relatively little.

High energy electron flux is expected to remain mostly at Normal Background levels, but may respond to any fast wind enhancement, increasing to Moderate or perhaps temporarily peaking at High levels on days 3 and 4 (15 and 16 July). The associated 24-hour fluence is expected to remain below the Active level, but with a slightly increasing trend from tomorrow.

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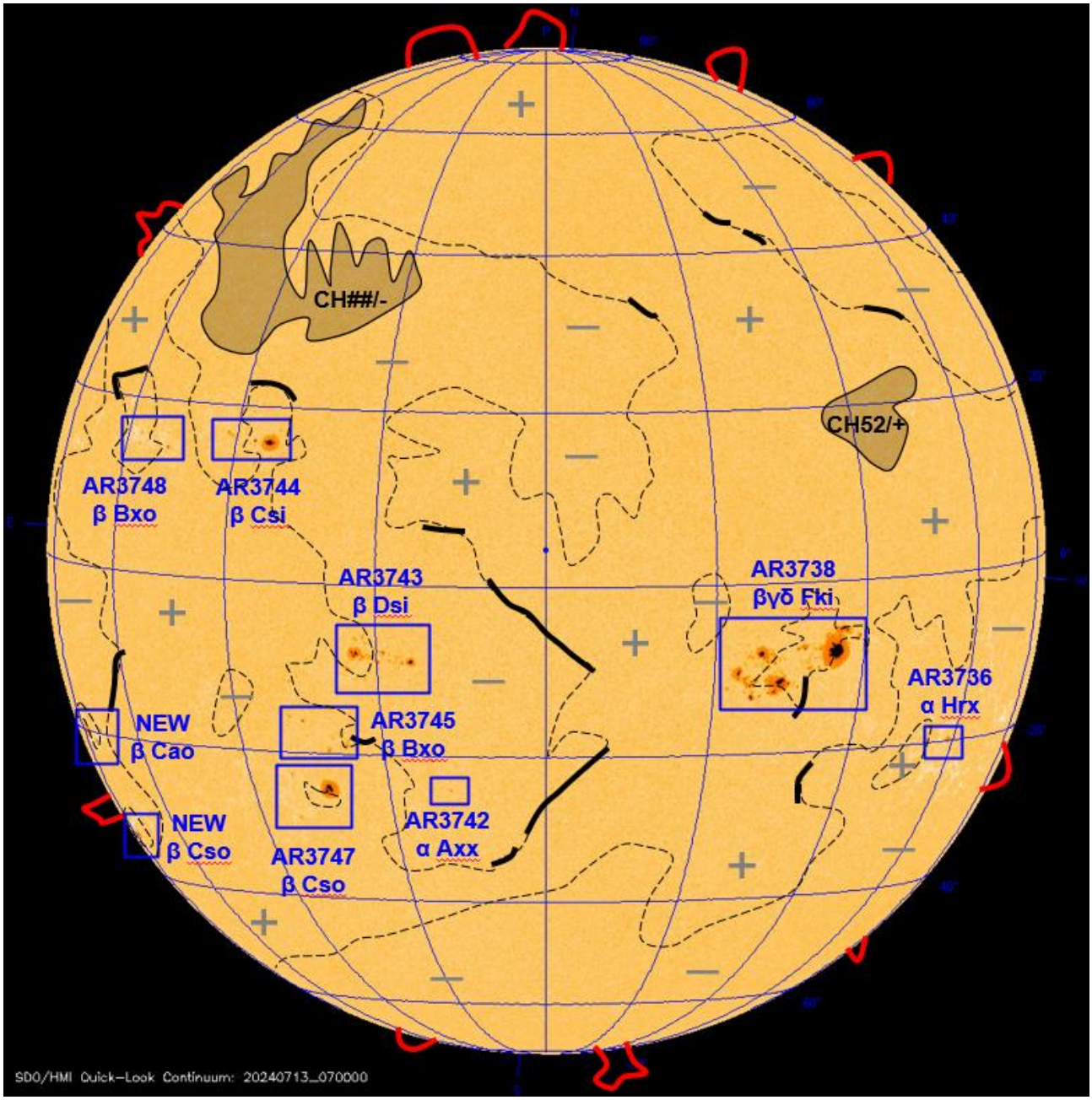
Figure 1. Solar Analysis Valid 13/0700 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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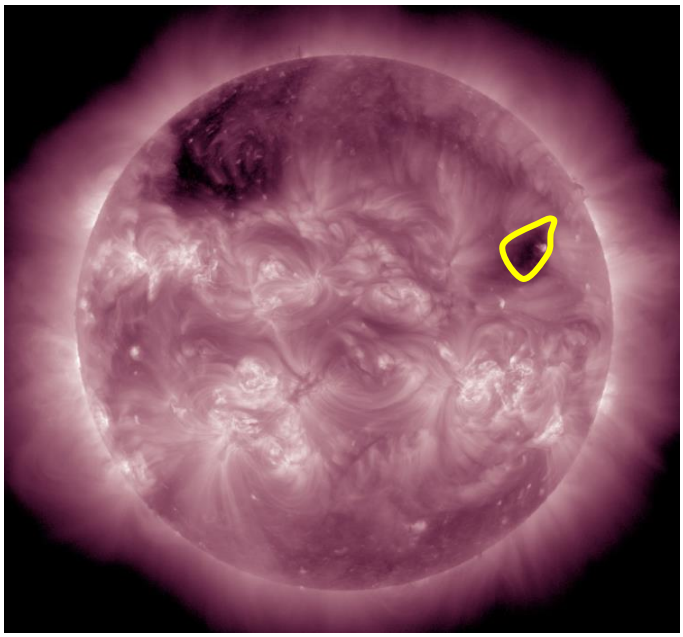
Geomagnetic Storms:
No CMEs feature in the current forecast.

Initial slow wind conditions are expected to be followed by a slight enhancement due to the onset of the fast winds from CH52, these expected to arrive later today (13th) and then persist for up to two days. CH52 was a broad positive coronal hole, although has reduced in size over the last 24 hours. However, a fast wind onset is likely to occur later today (13th) or early day 2 (14th). Enlil is currently providing poor guidance due to the over-estimation of a small southwestern coronal hole which did not connect with Earth, as Enlil indicates. Elevated winds are likely by the end of today into tomorrow (13-14 July), potentially increasing activity to Active to G1/Minor Geomagnetic Storm levels - a peak for the forecast period. Through day 3 (15 July) solar wind speeds are expected to gradually decline, probably back to Background levels, as geomagnetic activity also declines.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	50	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO/AIA 211 image showing CH52 in the northwest, which has reduced in size over the past 24 hours. Source of potential high speed stream likely to arrive later today (13th) or tomorrow (14th).



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Radio Blackouts - X-Ray Flares:
There are eight numbered regions on the disc, and two new unnumbered regions rotating onto the east limb. The largest and most complex region remains AR3738. This region has recently slightly expanded its penumbra within its intermediate spot, leading to the development of a small delta spot, and is now classified as an Fki/Beta-Gamma-Delta configuration. This region has recently produced an M1.4 flare, observed at 13/0318UTC. The other region of note is AR3743 in the southeast, which is currently classified as Dsi/Beta, although continues to show some minor growth in its intermediate portion. The remaining regions are all smaller, magnetically simpler, and either stable or displaying small insignificant changes. No significant regions are due to depart or arrive through the period.

There is Likely to be further M-class flares, probably from AR3738, due to its size and magnetic complexity, but also to a lesser extent from AR3743 in the southeast. Slight Chance of an isolated X-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES X-Ray Flux trace.

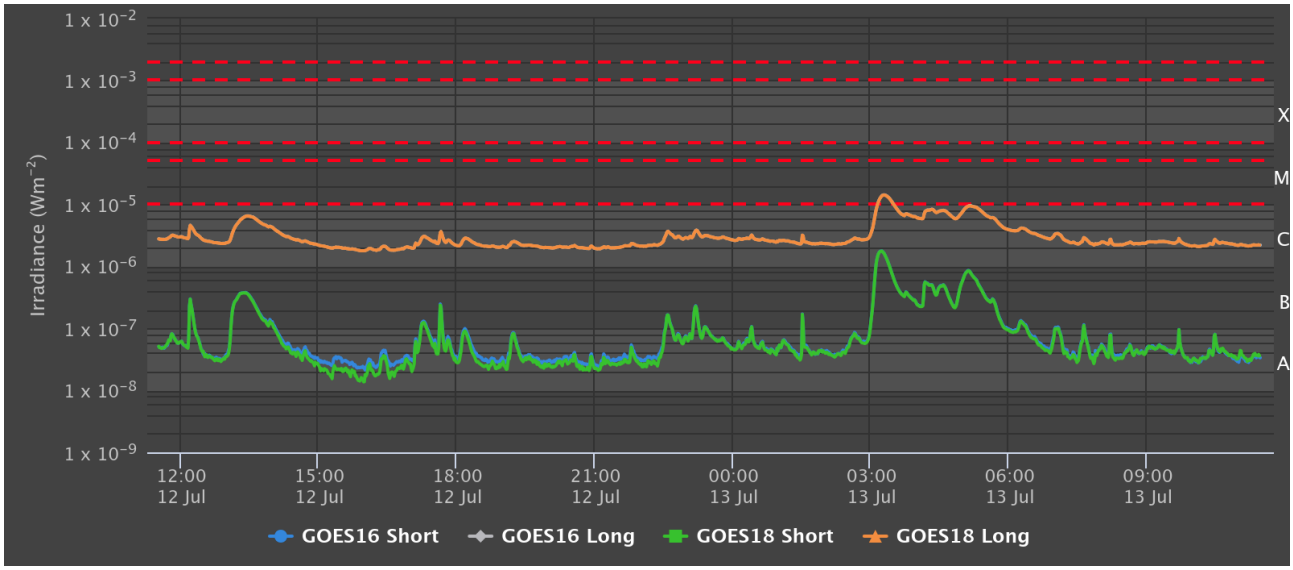

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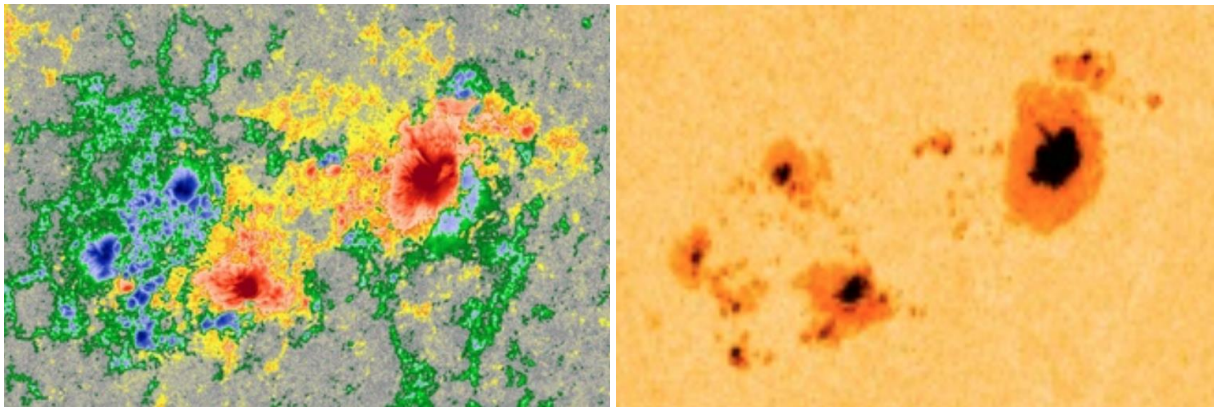
Figure 4: Latest SDO/AIA images of AR3738 – magnetogram (left) and intensitygram (right).



Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at Background levels. It is most likely to remain at background levels, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any significant flares occur, these perhaps most likely from AR3738. As this region rotates across the southwest quadrant, the probability of reaching S1 increases slightly.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux observed at GOES16 has been at predominantly Normal Background levels. Fast wind enhancements from coronal 52 are expected to occur today and tomorrow (13th and 14th), which may eventually increase electron populations at GEO. However, the scale of these enhancements is not expected to be large, and the onset of any upward trend in fluence will probably not occur immediately. MOSWOC REFM is producing good guidance, keeping the fluence well below the Active threshold (1e8 integrated flux) while indicating a slight rising trend later in the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	15
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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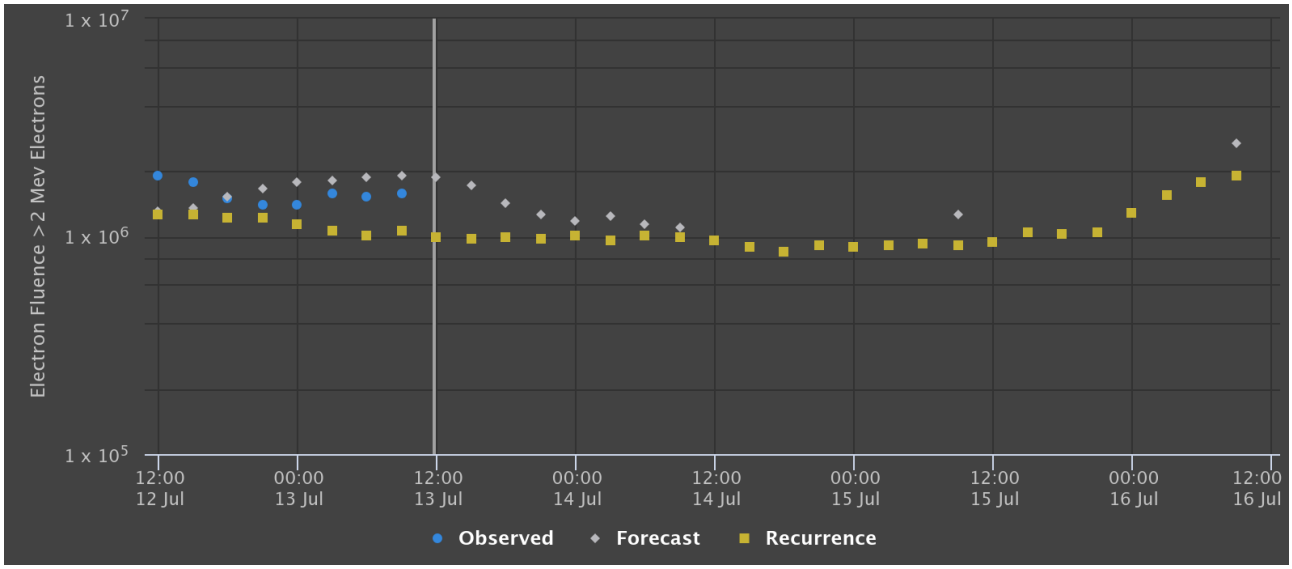
Figure 5: MOSWOC REFM electron fluence – observations, forecast and recurrence.



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